Case History

ClearDepth™ Hydraulic Simulation Software Coupled with Extensive Laboratory Testing Ensures Successful Engineered Displacement Process, Algeria

Successful deployment of Newpark's proprietary solution followed extensive testing, modelling and planning.

CHALLENGE	SOLUTION	RESULT
• **Engineered Displacement from non-aqueous drilling fluid to clear-brine fluid** • **To avoid costly NPT and potential damage to the producing reservoir, there was zero margin for error**	• **Extensive laboratory evaluation & testing** • **Newpark's proprietary ClearDepth™ hydraulic simulation software**	• **Engineered Displacement process successfully executed first-time, effectively and efficiently** • **Turbidity of the clear-brine fluid was measured at 20 NTU**

OVERVIEW

An operator in Algeria requested Newpark to execute an Engineering Displacement process following the company's procedures.

The process displaces a drilling fluid to a clear brine fluid, and this procedure was designed to mitigate risks, minimize waste of clear brine fluid, and maximize the quality of the incoming brine into the well.

Success depends on faultless execution at the first attempt, any mishaps or mistakes during this process will lead to non-productive time (NPT). Additional costs would begin to accumulate, the well integrity could be compromised, and hydrocarbon production could be impacted.

Newpark Fluids Systems' engineering displacement process is built on comprehensive laboratory testing protocol and validated using our proprietary ClearDepth™ advanced hydraulic software.

CHALLENGE

The goal for the operator was to perform a displacement, having drilled the vertical well to 4,166m total vertical depth (TVD), to run and set the 7" liner with optimized cleaning and minimal contamination between the non-aqueous drilling fluid and the clear-brine completions fluid.

The clear-brine fluid was expensive and short on supply, comprising calcium chloride and calcium bromide, requiring a successful and efficient first-time execution of the displacement process to avoid expensive NPT.

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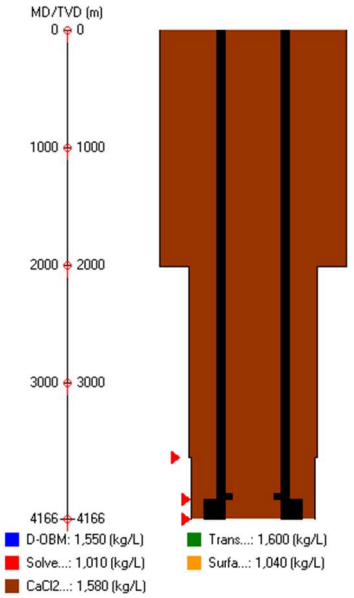
Case History

SOLUTION

Newpark's engineered displacement process follows these steps:

- Develop a full understanding of the downhole formation and fluid interactions
- Analyze the fluid in the well and the fluid used in the process to evaluate the options for displacement pills
- Laboratory testing, including the "spacer compatibility test" to evaluate fluid interactions, and the "standard displacement clean-up test" to evaluate cleaning/detergent efficiency of the train of pills designed
- Displacement simulation with the ClearDepth™ hydraulic modelling software, which includes the following primary features:

  - Up to 16 operation stages for land wells
  - Combination of nine flow paths for deepwater operations
  - Free-fall/back-fill (U-tubing) calculation
  - ECDs/pressures at various depths vs. time
  - Up to 12 fluids for each stage
  - Circulating temperature prediction
  - Fluid compressibility
  - Pressure and temperature dependent rheology
  - Effects of pipe standoff on hydraulics
  - Circulation sub and gravel pack
  - Coiled tubing operation
  - Oil field, SI, and customized units
  - Flow split with two circulation subs



The makeup of the formation is unique to that region of Algeria

	Description	TVD (m)	Pore (kg/L)	Frac. (kg/L)
1	Shale	3680,00	1,300	2,000
2	Volcanic Rock	3780,00	1,500	2,000
3	Sandstone	3868,00	1,500	2,000
4	Shale	3933,00	1,300	2,000
5	Sandstone	4200,00	1,500	2,000

RESULTS

As a result of the extensive testing, planning and modeling, the Engineered Displacement was successfully executed first-time, effectively and efficiently.

Turbidity of the clear-brine fluid was measured at 20 nephelometric turbidity units (NTU), achieving the exacting demands of the customer's protocol.